Installation & User Manual

Commercial Voltage Optimisation Unit

63 amp - 200 amp

3 Phase

Made in Britain

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Introduction

This Installation & User Manual covers the installation and use of the Apex Commercial Voltage Optimisation (VO) units.

Apex Energy has a range of 3 phase voltage optimisation products ranging from 63A, 100A, 160A and 200A.

These units have been specifically designed to suit a wide range of applications and can be installed on main incoming supplies or on sub circuits to reduce energy costs on targeted, specific loads.

The units are self commissioning and are fully automated to ensure optimum savings are achieved as well as ensuring continuity of supply even during bypass operation.

The Apex Voltage Optimisation (VO) units are supplied in 2 frame sizes.

Each device in the range of Apex Voltage Optimisation (VO) units is supplied complete with a 3 pole moulded case circuit breaker and LCD display.

	Rating	**Fixing**
Size 1	63A, 100A & 160A	Wall Mounted
Size 2	200A	Floor Mounted

Table 1

All Apex Voltage Optimisation (VO) units feature an LCD indicator display status to identify the following conditions; "*Mains On*", "*Unit in Save Mode*" & "*Unit in Bypass Mode*"

The LCD display on the front of the unit also shows "*incoming voltage"*, "*outgoing voltage"* and "*current drawn"* per phase.

The incoming voltage to a site will vary around the country but by law it can be between 216v and 253V for single phase supply (374V to 438V for three phase supply). However, high voltages and sudden voltage surges can damage electronic equipment and cause premature failure due to the stresses a high voltage applies.

All electrical equipment is designed to work within a range of 207v and 253v for single phase (358v to 438v for three phase) if it complies with European Conformity CE. But, critically, the optimum and most efficient supply voltage for these appliances is 220V single phase 380V 3 phase.

When the supply voltage exceeds 220V wasted power can be generated, as both heat and vibration. This could significantly reduce the life span and efficiency of the equipment.

The commercial range of Apex Voltage Optimisation (VO) units features a "Dual Tap" function. This enables the unit to automatically select the correct voltage tap setting according to the incoming voltage typically this will be either 18V or 9V reduction. Or in the case of a sudden and low incoming supply voltage the VO unit will not further reduce the voltage at all by automatically selecting a 0V reduction setting.

This offers 2 major benefits.

1) Prevents the site voltage going below the recommended lower voltage.
2) Ensures that even when the incoming voltage drops, the Apex VO unit can automatically adjust to a lower tap setting, ensuring that savings are still being achieved.

Electric loads that will deliver energy savings are those that are known as “voltage dependent” loads.

Appliances that will benefit from voltage optimisation are typically;

- Refrigeration loads.
- Air conditioning without invertors.
- Electric motors without speed drives.
- Heating pump motors.
- Metal Halide / SON Lamps.
- Incandescent lamps.
- Compact fluorescent lamps.
- Fluorescent tubes T8 / T12.
- Halogen lighting indoor and outdoor.
- LED lighting.
- Process loads.

* *Savings may vary between different manufacturers.*

In addition to energy saving, the Apex VO unit can also protect your appliances from harmful over voltages and spikes that can significantly reduce the electrical life of sensitive electronic equipment.

The Apex VO units have a dedicated electronic control unit (**ECU**) which intelligently and constantly monitors all the parameters such as incoming voltage, outgoing voltage, load, current, temperature, even its own performance ensuring the unit always delivers the optimum performance to the premises.

The Apex VO unit will automatically select the correct level of voltage reduction (18V or 9V) or even to bypass (0V reduction) depending on the algorithm of conditions.

Incorporating the latest sine wave sampling (**SWS**) and active sine wave mapping (**ASWM**) technology enables the unit to monitor and control three critical performance and safety functions.

1) Low Voltage Threshold (**LVT**) eliminates the risk of the optimised voltage falling below a minimum target voltage. When it detects the voltage has recovered and stabilised it automatically switches back to 'save' mode.

2) High Current Threshold (**HCT)** protects against over current. The unit will automatically detect this and remains in a temporary 'bypass' mode until the over current reduces.

3) Optimum Switching Threshold (**OST**) by constantly mapping the sine wave, the Apex VO unit will only switch at the optimum point, which eliminates any interruption to the supply voltage. It also eliminates spikes and transients.

Purpose

The purpose of the Apex VO unit is as follows:

- Reduce energy waste and carbon footprint by reducing the power consumed by appliances.
- Contribute to Government funded targets on carbon reduction.
- Generate end user savings, which start immediately after installation.
- Substantially extend the life of appliances and lighting.
- Protect sensitive electrical devices from damage caused by higher voltages.

Important Points

- Familiarise yourself with this manual and the Apex VO unit before installing and / or operating the unit.
- In particular, ensure that you have read the WARNINGS AND CAUTIONS section.
- Consider the requirement for a main Isolator switch or bypass switch depending on the application.

WARNINGS AND CAUTIONS

These warnings and cautions must be observed when installing and/or operating the Commercial Voltage Optimisation Unit.

WARNING 1

ELECTRICITY CAN KILL. INSTALLING THIS EQUIPMENT WITHOUT ISOLATING THE SUPPLY IS NOT ONLY DANGEROUS BUT CONTRAVENES THE ELECTRICITY AT WORK REGULATIONS 1989.

WARNING 2

MAKE SURE THAT MAXIMUM CONDUCTIVE CABLE SURFACE IS IN CONTACT WITH TERMINALS AND THAT THEY ARE SECURE. LOOSE CONNECTIONS CAN CAUSE ARCING THAT MAY RESULTS IN HEAT DAMAGE TO COMPONENTS AND ULTIMATELY FIRE.

WARNING 3

THIS WORK MUST BE CARRIED OUT BY A REGISTERED ELECTRICIAN.

CAUTIONS

- Install the VO unit in free air ventilation
- Make sure the installation location is clean and dry
- The unit must never be covered.

Installation

The configuration of a typical commercial installation is illustrated in Figure 1. The configuration when integrated with a typical PV installation is illustrated in Figure 2.

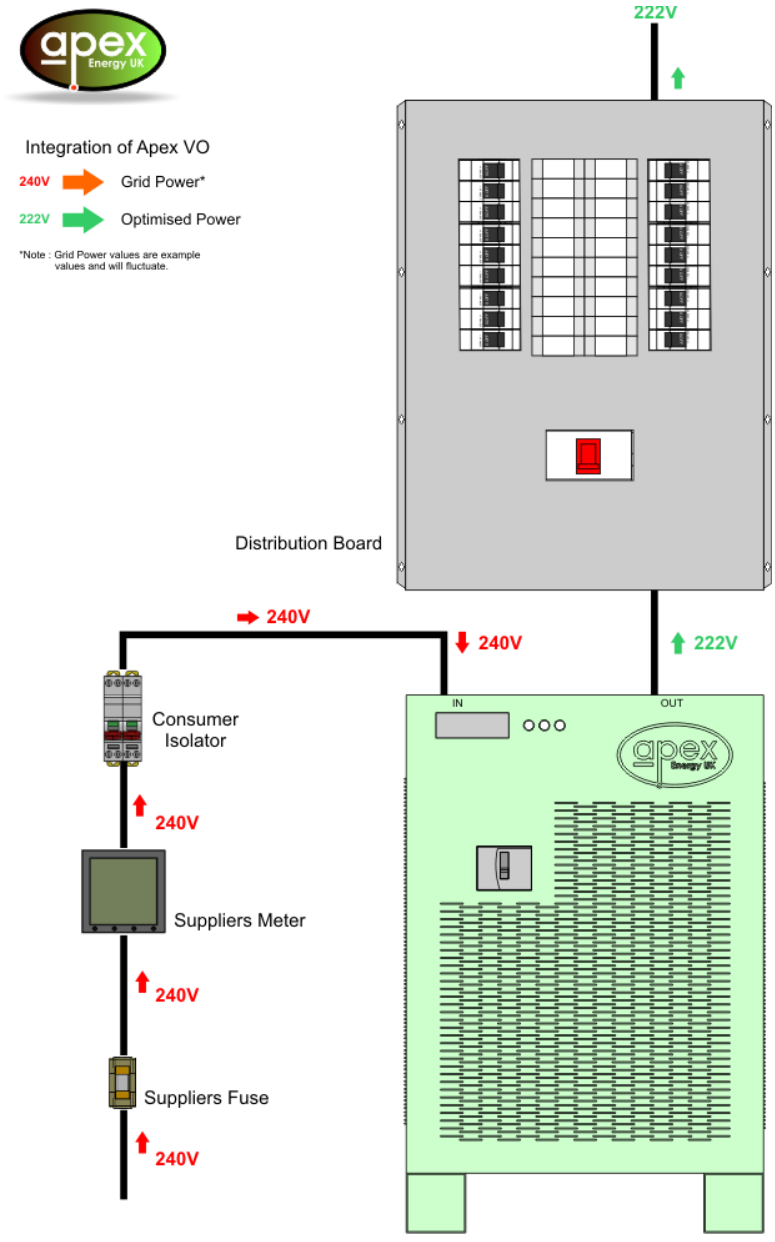


Figure 1: Typical Commercial Installation

Note: Before commencing with the installation:

- Make sure that you have the correct CSA and length of tails. Refer to Appendix 6 of the BS7671 On Site Guide;
- Establish how isolation is to be achieved. If an isolation switch is not installed you must establish a suitable means of Isolation from the supply. Visually inspect for damage /ingress, check connections and test as per BS7671 prior to activation

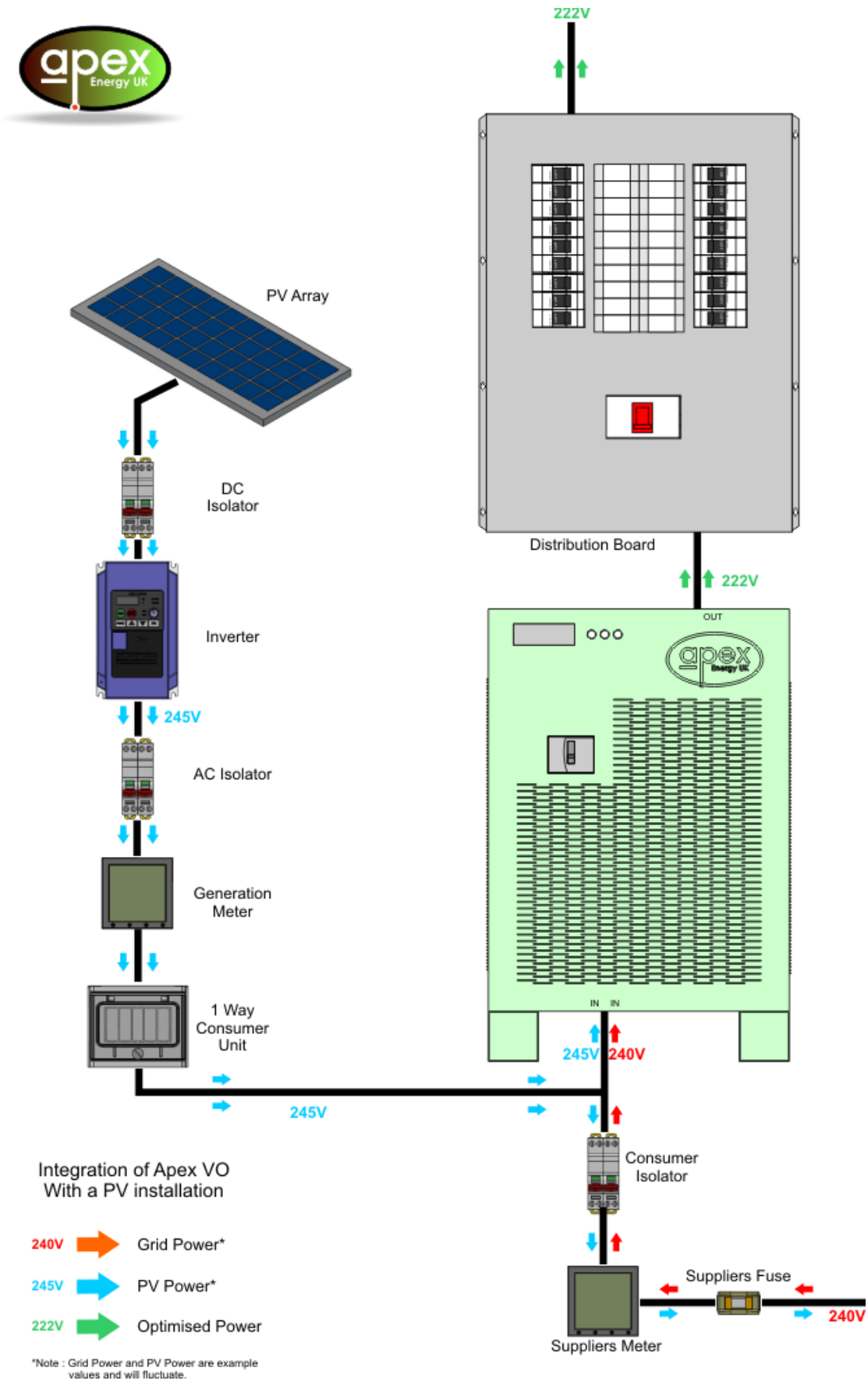


Figure 2: Typical installation with PV solar power system

1. The 63A, 100A and 160A three phase commercial units can be wall mounted.
   The 200A three phase commercial unit is recommended for floor mounting only.
2. Cable entries are supplied on side or the top of the 200A units via the gland plate. And via the top gland plate on the 100A unit.
3. Remove the front cover to allow access to the mounting plate fixing and the terminations for the supply and feed cables.
   a. Secure the base to the wall as follows; *63A, 100A and 160A units only*
   b. Choose a location for the base unit of the Apex VO unit, either horizontally or vertically on a solid surface in a convenient position for access and in a well-ventilated and dry location. Ensure the unit has a minimum **100mm** clearance all around for ventilation.

CAUTION

If the unit is to be installed vertically the transformer must be positioned uppermost.

   c. Measure and mark positions of the six (6) securing screws, according to whether the unit is to be mounted horizontally or vertically. The dimensions of the hole centres are given in Figure 3.
   d. Drill appropriate size hole for either direct fixing into wood or the correct type of wall plugs for plasterboard, brick etc.
   e. Use M12 screws with wall plugs if appropriate. Leave the heads of the screws protruding sufficiently to locate in their relative location holes in the base unit.
   f. Locate the base unit on the M12 screws; if necessary, tighten the screws to prevent any movement of the base unit but do not tighten fully as it should be made possible for the unit to slide in and out of position.

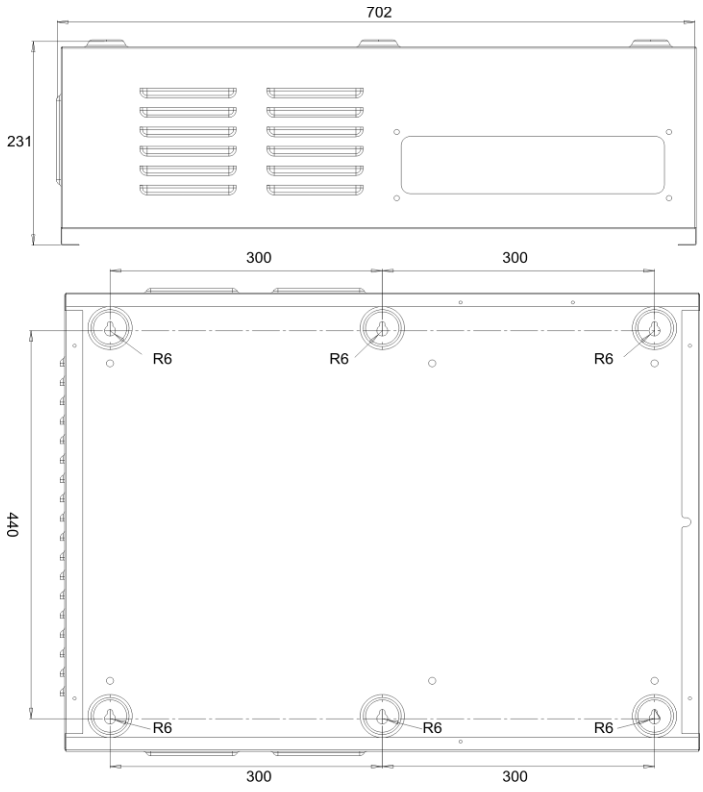


Figure 3: Dimensions of mounting hole centres (63A, 100A and 160A Wall Mounted Unit Only)

4. Check the phase rotation of the site prior to disconnection
5. Isolate the supply to the premises at the isolation switch.

6. Connect the incoming supply tails directly to the Apex VO unit *Isolator* or *Mould Case Circuit Breaker (MCCB)* (see Figure 4) .
7. Connect the outgoing tails from the VO unit into the connection block as shown in Figure 4.

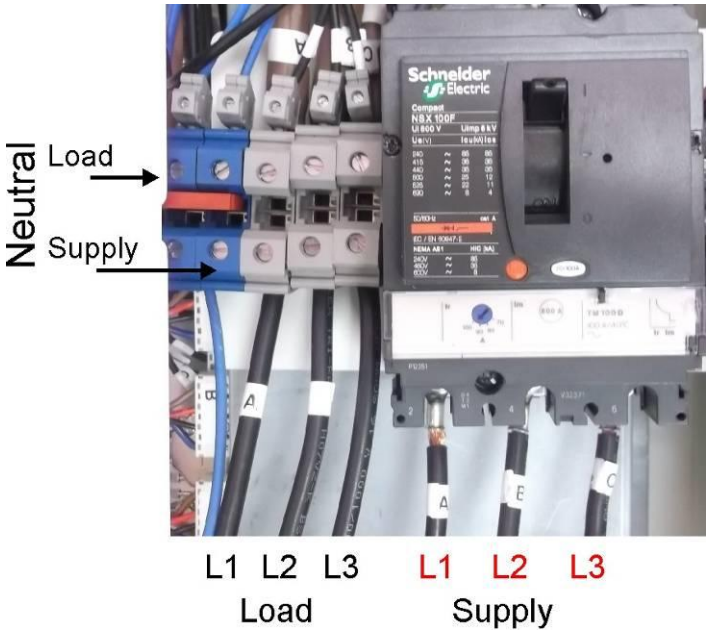
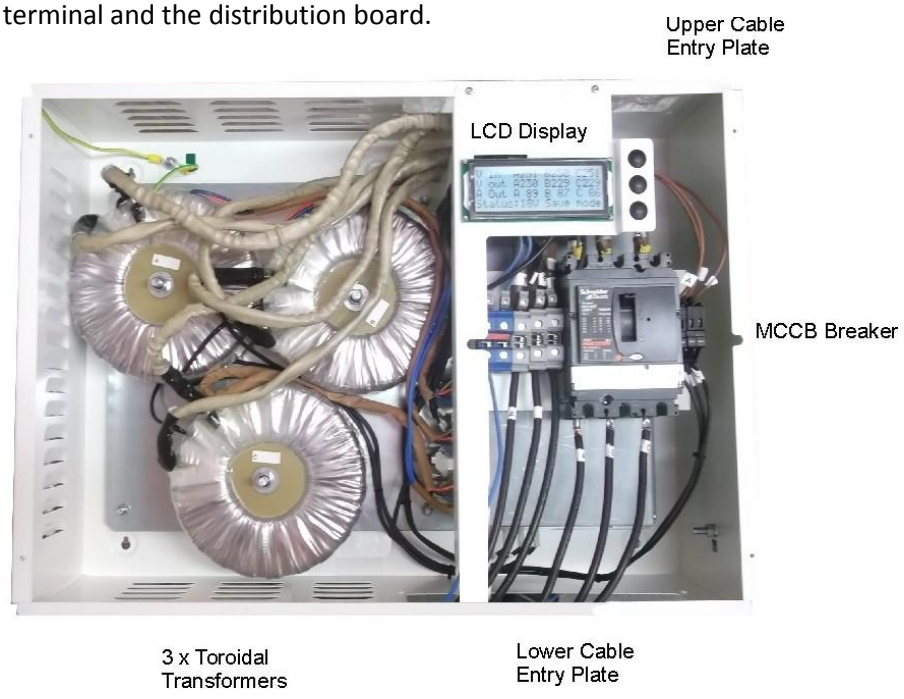


Figure 4: Cable installation x 3 for 3 Phase connections

8. Connect the correct size earth bonding cable (refer to Chapter 4 of the BS7671 On Site Guide) between the main earth terminal and the chassis of the Apex Voltage Optimisation (VO) unit, using a terminal lug crimped to the earth cable.

   Note: Leave the main earth conductor (usually 16mm² CSA) connected between the main earth terminal and the distribution board.



9. Carry out the following dead checks:
    - Continuity of all cables
    - Polarity of the live and neutral.
    - Insulation between phase and earth.
10. Carry out the following live checks:
    a. Carry out a Phase rotation check to ensure the same polarity prior to install.
    b. Earth Loop Impedance, check it is within limits (max Zs) for the protective devices installed within the Apex VO unit, refer to BS7671 17th edition chapter 4.
    c. Prospective fault current if not obtained by enquiry make sure this does not exceed the breaking current of the unit.
    d. Input Voltage
    e. Output Voltage.
11. Record results obtained in steps 9 and 10 on an installation certificate and include a copy for the consumer; refer to Appendix 7 BS7671 OSG.
12. Replace the cover and secure with the four screws.
13. Re-instate the supply and turn on the Apex VO unit and leave it to go through its self-setting procedure.

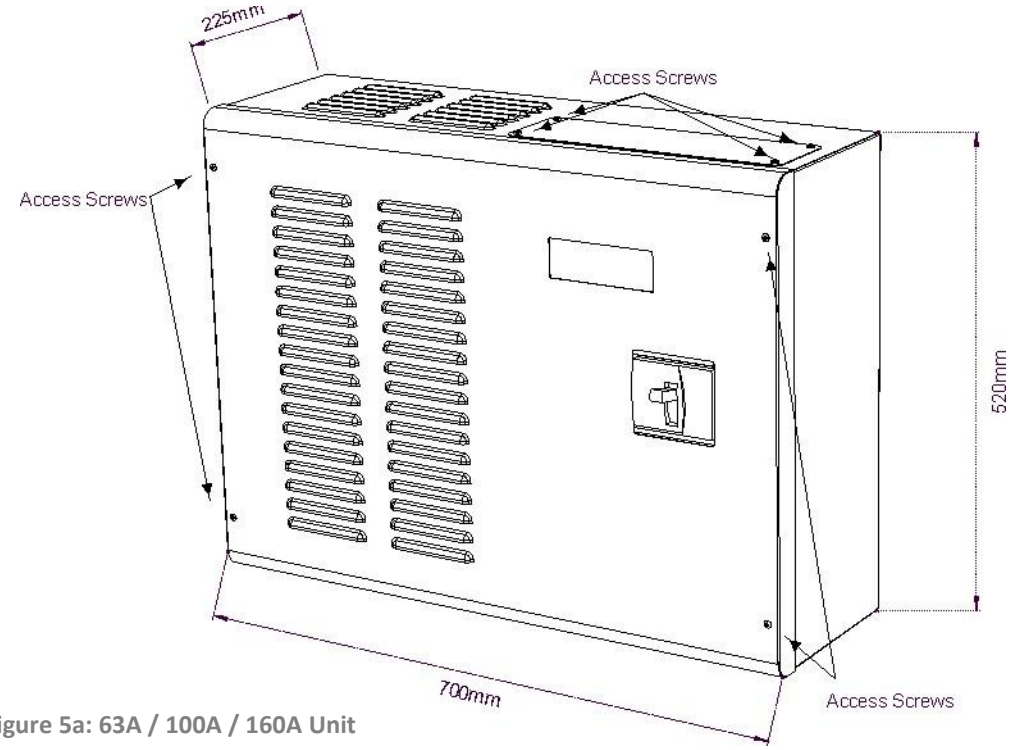


Figure 5a: 63A / 100A / 160A Unit

Operation

The Apex VO unit constantly monitors the input supply voltage and current and will automatically control the supply within the parameters of the product. The incoming supply will fluctuate constantly; the Apex VO unit will react as follows;- A “click” noise may be heard from the unit as it changes state, this is normal. Depending on the incoming supply voltage the VO unit will select one of the two voltage taps automatically.

Under Voltage

The incoming supply will fluctuate constantly; Where a risk of under voltage exists the Apex VO will automatically revert back to mains voltage (the minimum voltage threshold will be 218V supply)

Over Current

The Apex VO unit must NOT be subjected to a current on any phase that is above its name plate rating. Suitable thermal protection **MUST** be installed downstream of the Apex VO unit to protect the unit from irreparable damage that will be caused should this happen.

The operating status of the Apex VO unit is indicated by the LCD display on the front of the unit (Refer to Figure 7)

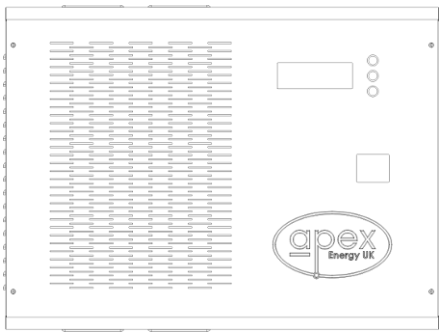


Figure 7: 63A / 100A / 160A Apex VO unit

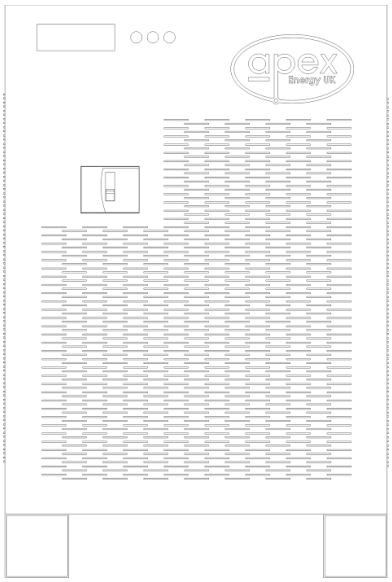


Figure 7b: 200A Apex VO unit

The Apex VO unit will instantly switch to “save“mode when it is powered up and switched on.

Should the Apex VO unit detect a low voltage on any one of the three phases it will automatically revert to a bypass condition until the voltage is high enough to allow “save“ mode to be selected. There may be a delay between these states as the Apex VO unit is establishing that the supply voltage has stabilised.

Status Indications

The status indicated by the LCDs is described in the following table.

Line 1: Incoming voltage/phase

Line 2: Outgoing voltage/phase

Line 3: Current Drawn/phase

Line 4: VO unit status &
current voltage reduction tap i.e. " 18V reduction tap active and the VO unit is in save mode.

Under Voltage

The incoming supply will fluctuate constantly; where a risk of under voltage exists, e.g. when the outgoing voltage goes below 216V on any phase the Voltage Optimiser will automatically revert back to mains voltage. Once the Voltage has recovered the VO unit will automatically revert back to save mode. The status on the LCD panel will display "Under Voltage / Bypass" .

Over Current

Should the demand exceed the maximum continuous rating of the Voltage Optimiser. The LCD panel will display "Over Current " and the unit will "Trip the MCCB" at 10% above max rated current. This operation will remove the supply to the site and will require a manual reset of the MCCB.

Over Temperature

Depending on the load conditions and the ambient temperature the voltage optimiser contains several over temperature protection devices.

These are designed to prevent the unit being damaged. Should this occur the unit will automatically switch into bypass mode until the unit has cooled sufficiently to automatically revert back to save mode. The LCD panel will display "over temperature".

Bypass Mode

This mode is automatically selected by the Voltage Optimiser for reasons, either of savings or for reasons of protection. This mode means that the supply voltage to the house will continue and will not be interrupted; however the Voltage optimiser is not reducing the voltage at this time. The LCD panel will display "Bypass mode".

Troubleshooting

WARNING 4

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WARNING 5

TROUBLESHOOTING THAT REQUIRES THE REMOVING OF INSULATING COVERS MUST ONLY BE PERFORMED BY A QUALIFIED ELECTRICIAN.

Warranty

The Commercial Voltage Optimisation Unit is guaranteed for one year from the date of purchase. The installer will record the serial numbers of the Apex VO unit and the circuit board on the warranty card.

This warranty card must be sent to Apex Energy to increase the warranty to three years.

Technical Specification

Incoming Voltage	232V – 264V
Outgoing Voltage	214V – 235V
Frequency	50 / 60Hz
Voltage Reduction	18V or 9V – Twin Tap automatically selected
Humidity	85%
Ambient Operating Temperature	-10 to +40°C
Efficiency	>99%
Insulation Class	BS2757 120 degree maximum
IP Rating	IP 23
Cooling	Case is naturally ventilated
Voltage Surge	Able to withstand 3.3kv for 60 seconds
Breaking Current	10kA
Temperature rise @ 50% FLC above ambient	63A = 18 degrees 100A = 18 degrees 160A = 18 degrees 200A = 18 degrees
Noise Emissions	All units < 5db
Operating Current	Continuous Maximum current dependant on model, 63A, 100A , 160A, 200A
Dimensions	63A - H = 520mm W = 700mm D = 225mm 100A - H = 520mm W = 700mm D = 225mm 160A - H = 520mm W = 700mm D = 225mm 200A - H = 600mm W = 800mm D = 370mm
Weight	63A = 42kg 100A = 71kg 160A = 97kg 200A = 97kg

INSTALLATION & USER MANUAL

COMMERCIAL VOLTAGE OPTIMISATION UNIT

Designed, developed and manufactured in the UK by
Apex Energy UK
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